REMARKS

The Official Action mailed June 18, 2002 has been received and its contents carefully noted. Filed concurrently herewith is a *Request for Two Month Extension of Time*, which extends the shortened statutory period for response to November 18, 2002. Accordingly, Applicant respectfully submits that this response is being timely filed.

Applicant notes with appreciation the consideration of the Information Disclosure Statement filed on June 8, 1999. However, Applicant has not received acknowledgment of the Information Disclosure Statement filed on August 21, 2001. Applicant respectfully requests the Examiner to provide an initialed copy of the Form PTO-1449 evidencing consideration of this Information Disclosure Statement.

Claims 2-13 and 20-23 were pending in the present application. Claims 4 and 5 have been withdrawn from consideration and claims 2-8, 20 and 21 have been amended herewith. Claims 2, 3, 6-13 and 20-23 are now pending in the present application, of which claims 2, 3, 6, 8, 20 and 21 are independent. Non-elected claims 4 and 5 have been amended herewith to place them in better form for allowance upon allowance of generic claims 20-23. For the reasons set forth in detail below, these claims are believed to be in condition for allowance.

The present invention, as recited in the amended independent claims, is directed to a method of manufacturing a semiconductor device, comprising a first step of forming a semiconductor film over a substrate, a second step of holding a catalytic element that promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film, a third step of irradiating a laser beam shaped in a rectangle or a square while moving the laser beam from one side of said semiconductor film toward another side thereof to sequentially crystallize said semiconductor film to form a crystalline semiconductor film, a fourth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and a fifth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands, wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor, and wherein said laser beam has an irradiation area of said pulsed laser beam of 10 cm^2 or more.

Paragraph 2 of the Official Action rejects claims 2, 3, 6-13 and 20-23 as obvious based on the combination of U.S. Patent 5,830,784 to Zhang et al., U.S. Patent 5,569,610 to Zhang et al., JP 9312260 A to Ohtani et al. and U.S. Patent 5,869,803 to Noguchi et al. The Applicants respectfully submit that a *prima facie* case of obviousness cannot be maintained against the independent claims of the present invention, as amended.

As stated in MPEP §§ 2143-2143.01, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art. "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab,* 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000). See also *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The prior art, either alone or in combination, does not teach or suggest all the features of the independent claims, as amended. As noted in detail above, independent claims 2, 3, 6, 8, 20 and 21 have been amended to recite the features of forming a semiconductor film over a common substrate, holding a catalytic element in contact with an entire surface of the semiconductor film, patterning the semiconductor film to form islands, and forming first and second thin film transistors (TFT) using the islands, where a pixel matrix circuit comprises the first TFT, and where a driver circuit comprises the second TFT. Accordingly, the pixel matrix and driver circuits are formed on the common substrate, crystalline semiconductor film islands are formed using a catalytic

element, laser irradiation and patterning, and the pixel matrix and driver circuits comprise TFTs which are formed using the islands.

Zhang '784 discloses introducing a catalytic element into a region of an amorphous silicon film in order to form a boundary portion between TFTs or an edge portion of a TFT. However, Zhang '784 does not teach or suggest a pixel matrix circuit and a driver circuit over the same substrate. The Official Action concedes that Zhang '784 does not disclose "using a laser beam having a rectangular or square shape, gettering the catalytic element by the addition of phosphorous or boron through the oxide layer, and ... the irradiation area, and laser energy density of the laser beam" (p. 1, Paper No. 17). Also, Zhang '784 does not teach or suggest using either a catalytic element or laser irradiation in a region of an amorphous silicon film to form a TFT of a pixel matrix circuit.

Zhang '610 discloses a pixel matrix circuit and a driver circuit formed over the same substrate, a catalytic element introduced into a region of an amorphous silicon film to form a TFT of a peripheral driver circuit, and laser irradiation in a region of an amorphous silicon film to form a TFT of the peripheral driver circuit. However, Zhang '610 does not teach or suggest that a catalytic element is introduced into a region of the amorphous silicon film to form a TFT of a pixel matrix circuit (see Example 3 and Fig. 4). Zhang '610 also does not teach or suggest laser irradiation in a region of the amorphous silicon film to form a TFT of a pixel matrix circuit (see Example 1 and Fig. 1B).

Noguchi and Ohtani do not cure the above-referenced deficiencies in either Zhang '784 or '610.

The Official Action asserts that "it would be an inherent result of the annealing after doping with phosphorous or boron that the crystallization promoting element will go through a gettering process and will be removed from the crystallized silicon layer" (pp. 2-3) and that using a laser apparatus with the capability of having an irradiation area of 10 cm^2 or more is "just a matter of choosing equipment and preference" (p. 3). In accordance with MPEP § 2144.03, the Applicants respectfully traverse the above-referenced assertions and request that the Examiner cite references in support of their position. The Applicants respectfully submit that the above features are not

conventional and would not have been known to one with ordinary skill in the art at the time of the invention.

Furthermore, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify Zhang '784, Zhang '610, Noguchi and Ohtani or to combine reference teachings to achieve the claimed invention. The Official Action broadly asserts that it would have been obvious "to vary the ranges of the properties of the laser beam in order to obtain faster crystallization or a more defined crystallization" (p. 2). However, the Official Action provides no specific reason to modify or combine Zhang '784 and Zhang '610.

Even assuming motivation could be found, the Official Action has not given any indication that one with ordinary skill in the art at the time of the invention would have had a reasonable expectation of success when combining Zhang '784 and '610. And as noted above, Zhang '784 and '610 do not teach or disclose, alone or in combination, using either a catalytic element or laser irradiation in a region of an amorphous silicon film to form a TFT of a pixel matrix circuit.

Therefore, the Applicants respectfully submit that a *prima facie* case of obviousness cannot be maintained. Accordingly, reconsideration and withdrawal of the rejection of independent claims 2, 3, 6, 8, 20 and 21 under 35 U.S.C. § 103(a) is in order and respectfully requested. Likewise, it is believed that dependent claims 7, 9-13, 22 and 23 are allowable in that they depend from what is believed to be allowable base claims 2, 3, 6, 8, 20 and 21.

Should the Examiner believe that anything further would be desirable to place this application in better condition for allowance, the Examiner is invited to contact Applicant's undersigned attorney at the telephone number listed below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please amend claims 2-8, 20 and 21 as follows:

2. (Thrice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film over a substrate;

a second step of holding a catalytic element that [promote] promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film; [and]

a third step of irradiating a laser beam shaped in a rectangle or a square while moving the laser beam from one side of said semiconductor film toward another side thereof to sequentially crystallize said semiconductor film to form a crystalline semiconductor [film,] film;

a fourth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

a fifth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor, and

wherein said laser beam has an irradiation area of said pulsed laser beam of 10 cm^2 or more.

3. (Thrice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film on a substrate having an insulating surface;

a second step of holding a catalytic element that [promote] promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film; [and]

a third step of irradiating a laser beam shaped in a rectangle or a square from one side of said semiconductor film toward another side thereof while moving said substrate to sequentially crystallize said semiconductor film to form a crystalline semiconductor film,

a fourth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam; and

a fifth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor, and

wherein said laser beam has an irradiation area of said pulsed laser beam of 10 cm^2 or more.

4. (Twice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film over a substrate;

a second step of holding a catalytic element contained in a solution which promote the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film; [and]

a third step of irradiating a laser beam whose irradiation area in one shot is 10 cm^2 or more to said semiconductor film to crystallize said semiconductor film and to form a crystalline semiconductor film;

a fourth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam; and

a fifth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor.

5. (Twice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film over a substrate;

a second step of holding a compound containing a catalytic element which [promote] promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film; [and]

a third step of irradiating a laser beam whose irradiation in one area in one shot is 10 cm^2 or more to said semiconductor film to crystallize said semiconductor film and to form a crystalline semiconductor film;

a fourth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

a fifth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor.

6. (Twice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film over a substrate;

a second step of holding a catalytic element which [promote] promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film;

a third step of irradiating a laser beam whose irradiation area in one shot is 10 cm^2 or more to said semiconductor film to crystallize said semiconductor film and to form a crystalline semiconductor film; [and]

a fourth step of conducting a thermal oxide processing in an oxide atmosphere to form an oxide film on the surface of said crystalline semiconductor film and gettering said catalytic element to said oxide film to remove or reduce said catalytic element existing in said crystalline semiconductor film;

a fifth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

a sixth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor.

7. (Twice Amended) A method of manufacturing a semiconductor device as claimed in claim 6, further comprising a [fifth] step of removing said oxide film after said fourth step.

8. (Twice Amended) A method of manufacturing a semiconductor device, comprising:

a first step of forming a semiconductor film over a substrate;

a second step of holding a catalytic element which [promote] promotes the crystallization of said semiconductor film in contact with an entire surface of said semiconductor film;

a third step of irradiating a laser beam whose irradiation area in one shot is 10 cm^2 or more to said semiconductor film to crystallize said semiconductor film and to form a crystalline semiconductor film; [and]

a fourth step of selectively adding phosphorus or boron to said crystalline semiconductor film and gettering said catalytic element to said added region by conducting a heat treatment to remove or reduce said catalytic element existing in said crystalline semiconductor film;

a fifth step of patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

a sixth step of forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor.

20. (Thrice Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film comprising amorphous silicon on an insulating surface;

providing an entire surface of said semiconductor film with a crystallization promoting material comprising a metal;

crystallizing said semiconductor film by irradiating said semiconductor film with a pulsed laser beam,

patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor, and

wherein said laser beam has a pulse width of 200 nsec or more,

wherein said laser beam has an irradiation area of said pulsed laser beam of 10 cm^2 or more.

21. (Thrice Amended) A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor film on an insulating surface;

providing an entire surface of said semiconductor film with a crystallization promoting material comprising a metal;

crystallizing said semiconductor film by irradiating said semiconductor film with a pulsed laser beam having a square shape cross section,

patterning said semiconductor film to form at least first and second semiconductor islands after the irradiation of the laser beam, and

forming at least first and second thin film transistors, using said at least first and second semiconductor islands,

wherein a pixel matrix circuit comprises said first thin film transistor and a driver circuit comprises said second thin film transistor, and

wherein said laser beam has a pulse width of 200 nsec or more, and an irradiation area of said pulsed laser beam is 10 cm^2 or more.